

FORM PTO-1390 (REV 11-2000)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER <b>265-106</b>
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) <b>10/049809</b> unknown
INTERNATIONAL APPLICATION NO. <b>PCT/EP00/07236</b>	INTERNATIONAL FILING DATE <b>27/07/2000</b>	PRIORITY DATE CLAIMED <b>17/08/1999</b>
TITLE OF INVENTION <b>HIGH-FREQUENCY PHASE SHIFTER UNIT</b>		
APPLICANT(S) FOR DO/EO/US <b>GÖTTL, M. et al.</b>		
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</li> <li><input checked="" type="checkbox"/> The U.S. has been elected by the expiration of 19 months from the priority date (Article 31).</li> <li>A copy of the International Application as filed (35 U.S.C. 371(c)(2)).             <ol style="list-style-type: none"> <li><input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</li> <li><input checked="" type="checkbox"/> has been communicated by the International Bureau.</li> <li><input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li><input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).             <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> is attached hereto.</li> <li><input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</li> </ol> </li> <li><input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).             <ol style="list-style-type: none"> <li><input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</li> <li><input checked="" type="checkbox"/> have been communicated by the International Bureau.</li> <li><input type="checkbox"/> have not been made; however, the time limit for making such amendments has <b>NOT</b> expired.</li> <li><input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li><input checked="" type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li><input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li><input checked="" type="checkbox"/> A English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol> <p><b>Items 11 To 20 below concern document(s) or information included:</b></p> <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.</li> <li><input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.</li> <li><input checked="" type="checkbox"/> A FIRST preliminary amendment.</li> <li><input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</li> <li><input type="checkbox"/> A substitute specification.</li> <li><input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li><input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.</li> <li><input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</li> <li><input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</li> <li><input checked="" type="checkbox"/> Other items or information. PTO Form 1449 and 6 Cited References</li> </ol>		

SIGNATURE

25,327	February 19, 2002
REGISTRATION NUMBER	Date

#4/a

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

GÖTTL, M. et al.

Atty. Ref.: 265-106

Serial No. unknown

Group:

Filed: February 19, 2002

Examiner:

For: HIGH-FREQUENCY PHASE SHIFTER UNIT

\* \* \* \* \*

February 19, 2002

Assistant Commissioner for Patents  
Washington, DC 20231

Sir:

**PRELIMINARY AMENDMENT**

In order to place the above-identified application in better condition for examination, please amend the application as follows:

**IN THE SPECIFICATION**

Please substitute the following paragraphs in the specification for corresponding paragraphs previously presented. A copy of the amended specification paragraphs showing current revisions is attached.

Page 1, before the first line, please insert as a separate paragraph:

This application is the US national phase of international application PCT/EP00/07236 filed 27 July 2000, which designated the US.

**IN THE CLAIMS**

Please substitute the following amended claims for corresponding claims previously presented. A copy of the amended claims showing current revisions is attached.

3. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the connection lines (31a - 31d) at the same time represent transformers, via which the power is shared in a defined manner between the tapping sections (27a -27d) of the plurality of stripline sections (21a -21d).

4. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the tapping element (25) is formed like a radial point element originating from the pivoting axis (23).

5. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the share of the power which is fed in via the feed line (13) decreases from the innermost stripline section (21a) to the outermost stripline section (21d).

6. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the share of the power which is fed in via the feed line (13) increases from the innermost stripline section (21a) to the outermost stripline section (21d).

7. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that at least two of the stripline sections (21a - 21d), and preferably groups of at least two, or all, of the stripline sections (21a - 21d), are fed with the same power, or virtually the same power.

8. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the radius or diameter of the stripline sections (21a - 21d) increases by a constant factor.

9. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the distances between the stripline sections (21a - 21d) are 0.1 to 1.0 times the transmitted RF wavelength.

10. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the tapping sections (27a - 27d) are in the form of capacitively coupled tapping sections (27), which are each composed of flat strip conductors, between which a dielectric (37) is arranged.

11. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that a capacitive coupling is provided between the center tap (29), which is electrically connected to the feed line (13), and the coupling section (33), which is electrically

connected to the tapping element (25), and this capacitive coupling comprises a dielectric (37b) which is provided between two stripline sections.

12. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that this phase shift assembly is formed on a conductive, in particular metallic, base plate (25), which is preferably formed by the reflector of the antenna (1).

13. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that this phase shift assembly is shielded by a metallic cover.

14. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the connection line (31a - 31d) and the stripline sections (21a - 21d), together with the cover for the phase shift assembly, are in the form of a triplate line.

15. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the stripline sections (21a - 21d) each have a defined characteristic impedance.

16. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that a center tap (29) for the tapping element (25) is separated from, and is held above, the reflector (35) by means of a dielectric (37a).

19. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the center points of the stripline sections (21a to 21c) lie on the pivoting axis (23) of the tapping element (25).

20. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the center points of the stripline sections (21a to 21c) and the center point of the pivoting axis (23) are offset with respect to one another.

21. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the stripline sections (21a to 21c) have different thicknesses.

22. (Amended) The phase shift assembly as claimed in claim 1, **characterized** in that the stripline sections (21a to 21c) have different impedance values or identical impedance values, in particular around 50 Ohms.

24. (New) A radio-frequency phase shift assembly having the following features:

- characterized** by the following further features:

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Serial No. **unknown**

respective preceding further inward connection line (31a – 31c) which leads to the  
respective further inward tapping section (27a – 27c).

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Serial No. unknown

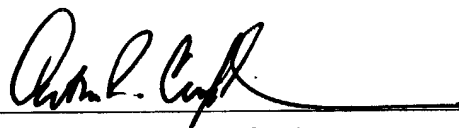
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**REMARKS**

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) is captioned "**Version With Markings To Show Changes Made.**"

Respectfully submitted,

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE SPECIFICATION**

Page 1, before the first line, please insert as a separate paragraph:

This application is the US national phase of international application PCT/EP00/07236 filed 27 July 2000, which designated the US.

**IN THE CLAIMS**

2. — ~~(Cancel)~~ The phase shift assembly as claimed in claim 1, **characterized in** that the connection lines (31a — 31d) at the same time represent transformers, via which the power is shared in a defined manner between the tapping sections (27a — 27d) of the plurality of stripline sections (21a — 21d).

3. (Amended) The phase shift assembly as claimed in claim 1, ~~2 or 3,~~ **characterized** in that the tapping element (25) is formed like a radial point element ~~originating from the pivoting axis (23)~~ connection lines (31a - 31d) at the same time represent transformers, via which the power is shared in a defined manner between the tapping sections (27a - 27d) of the plurality of stripline sections (21a - 21d).

4. (Amended) The phase shift assembly as claimed in claim 1, ~~2 or 3,~~ **characterized** in that the plurality of connections (31a — 31d) are arranged in an overlapping but isolated arrangement with respect to one another ~~parallel to tapping element (25) is formed like a radial point element originating from the pivoting axis (23)~~

such that the individual connection lines (31—31d) each start at the center tap (29) or at the central coupling section (33), and run to the respective tapping section (27a—27d) associated with a specific stripline section (21a—21d).

5. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 4~~, **characterized** in that the share of the power which is fed in via the feed line (13) decreases from the innermost stripline section (21a) to the outermost stripline section (21d).

6. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 4~~, **characterized** in that the share of the power which is fed in via the feed line (13) increases from the innermost stripline section (21a) to the outermost stripline section (21d).

7. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 6~~, **characterized** in that at least two of the stripline sections (21a - 21d), and preferably groups of at least two, or all, of the stripline sections (21a - 21d), are fed with the same power, or virtually the same power.

8. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 7~~, **characterized** in that the radius or diameter of the stripline sections (21a - 21d) increases by a constant factor.

9. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 8~~,  
**characterized** in that the distances between the stripline sections (21a - 21d) are 0.1 to  
1.0 times the transmitted RF wavelength.

10. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 9~~,  
**characterized** in that the tapping sections (27a - 27d) are in the form of capacitively  
coupled tapping sections (27), which are each composed of flat strip conductors, between  
which a dielectric (37) is arranged.

11. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 10~~,  
**characterized** in that a capacitive coupling is provided between the center tap (29),  
which is electrically connected to the feed line (13), and the coupling section (33), which  
is electrically connected to the tapping element (25), and this capacitive coupling  
comprises a dielectric (37b) which is provided between two stripline sections.

12. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 11~~,  
**characterized** in that this phase shift assembly is formed on a conductive, in particular  
metallic, base plate (25), which is preferably formed by the reflector of the antenna (1).

13. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 12~~,  
**characterized** in that this phase shift assembly is shielded by a metallic cover.

14. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 13~~,  
**characterized** in that the connection line (31a - 31d) and the stripline sections (21a -  
21d), together with the cover for the phase shift assembly, are in the form of a triplate  
line.

15. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 14~~,  
**characterized** in that the stripline sections (21a - 21d) each have a defined characteristic  
impedance.

16. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 15~~,  
**characterized** in that a center tap (29) for the tapping element (25) is separated from, and  
is held above, the reflector (35) by means of a dielectric (37a).

17. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 16~~,  
**characterized** in that the at least two stripline sections (21a, 21b) are curved, and in  
particular are in the form of circle segments.

19. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 18~~,  
**characterized** in that the center points of the stripline sections (21a to 21c) lie on the  
pivoting axis (23) of the tapping element (25).

20. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 17,~~  
**characterized** in that the center points of the stripline sections (21a to 21c) and the center  
point of the pivoting axis (23) are offset with respect to one another.

21. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 16,~~  
**characterized** in that the stripline sections (21a to 21c) ~~run in straight lines, and are~~  
~~preferably formed parallel to one another~~ have different thicknesses.

22. (Amended) The phase shift assembly as claimed in ~~one of claims 1 to 21,~~  
**characterized** in that the stripline sections (21a to 21c) have different  
~~thicknesses~~ impedance values or identical impedance values, in particular around 50  
Ohms.

23. ~~(Cancel)~~ ~~The phase shift assembly as claimed in one of claims 1 to 22,~~  
**characterized** in that the ~~stripline sections (21a to 21c) have different impedance values~~  
~~or identical impedance values, in particular around 50 Ohms.~~

24. (New) 2. A radio-frequency phase shift assembly having the following  
features:

- having at least two stripline sections (21a, 21b, 21c, 21d) which are  
arranged offset with respect to one another,

- having a tapping element (25)-which can be pivoted about a pivoting axis (23)

- the tapping element (25) is in this case furthermore connected at least indirectly to a feed line (13) such that the feed line (13) is electrically connected via a number of connection lines (31a, 31b, 31c, 31d) to the tapping sections (27) which are associated with the individual stripline sections (21a, 21b, 21c, 21d),

- the stripline sections (21a - 21c) run in straight lines, and are preferably formed parallel to one another

for this purpose, the respective connection line (31a – 31d) is formed with respect to a next, further outward stripline section (21b – 21d) by extending the respective preceding further inward connection line (31a – 31c) which leads to the respective further inward tapping section (27a – 27c).



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Radio-frequency phase shift assembly

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10 The invention relates to a radio-frequency phase shift assembly as claimed in the preamble of claim 1.

15 Phase shifters are used, for example, for trimming the delay time of microwave signals in passive or active networks. As a known principle, the delay time of a line is used to trim the phase angle of a signal and, in consequence, a variable phase angle means that the lines have a different electrically effective length.

20 For applications in antennas with an electrically adjustable notch in the polar diagram, the signals must have different delay times to the individual radiating elements, for example dipoles. The difference in the delay times between two adjacent radiating elements is approximately the same for a specific notch angle in an array of radiating elements arranged vertically one above the other. This delay time difference must now also be increased for larger notch angles. If the phase angles of the individual radiating elements are varied by means of phase shift assemblies, then this is an antenna with an adjustable electrical notch in the polar diagram.

35 According to WO 96/37922, a phase shift is known which has electrically moveable plates in order to produce a phase difference between different outputs, but at least between two outputs. This has the disadvantage that the movement of the dielectric plates also changes the impedance of the respectively affected lines, and

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the way in which the power of the signals is shared depends on the setting of the phase shifter.

5 The prior publication WO 96/37009 proposes a symmetrical line branching system in order to emit the same power at both ends of this line. This can be done provided both ends are terminated by the characteristic impedance of this line. Comparable solutions of technical principles have already been used for a long  
10 time for mobile radio antennas. However, these have the disadvantage that only two radiating elements can be supplied, and they also still receive the same power. A further disadvantage is the electrically conductive connection between the input and the respective lines,  
15 which necessitates moving, but electrically high-quality contacts which may have undesirable nonlinearities, however.

Finally, in principle, it is also known for a number of  
20 phase shifters to be integrated in one antenna, via which phase shifters the individual radiating elements in the entire antenna arrangement are supplied. Since, however, individual radiating elements must have different phase differences, the phase shift assembly  
25 settings must differ for the individual radiating elements. This necessitates complex mechanical step-up transmission systems such as those shown, in principle, in Figure 1, which shows a corresponding design according to the prior art.

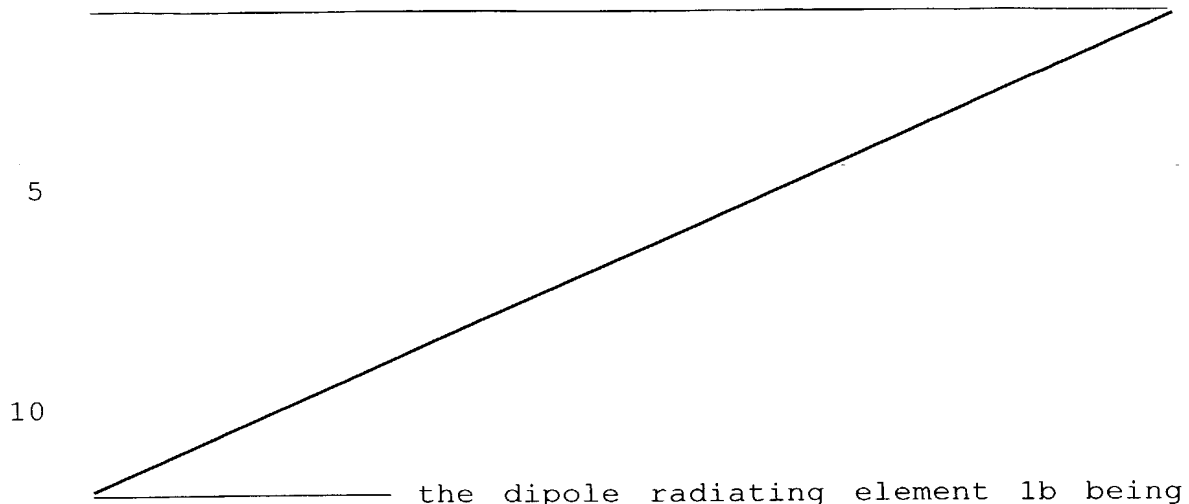
30 To this end, and in order to illustrate the prior art, Figure 1 shows, schematically, an antenna array 1 having, for example, five dipole elements 1a to 1e which, in the end, are fed via a feed input 5.

35 The feed input 5 is followed by a distribution network 7 which, in the illustrated exemplary embodiment, supplies two RF phase shift assemblies 9, that is to say two phase shift assemblies 9', 9'' in the

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the dipole radiating element 1b being supplied with a phase  $+1\phi$ , the central dipole radiating element 1c being supplied with the phase  $\phi = 0$ , the fourth dipole radiating element 1d being supplied with the phase  $-1\phi$ , and the last dipole radiating element 1e being supplied with the phase  $-2\phi$ .

In consequence, the phase shift assembly 9' must therefore ensure a split of  $+2\phi$  and  $-2\phi$ , and the second phase shift assembly 9'' must ensure a phase shift of  $+\phi$  and  $-\phi$ , for the respectively associated dipole radiating elements. A correspondingly different setting for the phase shift assemblies 9 can then be ensured by a mechanical actuating drive 17. In this case, it must be regarded as being disadvantageous that a comparatively complex mechanical step-up transmission 17 is required in order to produce the different phase differences required for the respective individual radiating elements.

A phase shift assembly of this generic type is known from PATENT ABSTRACTS OF JAPAN Vol. 1998 No. 1, January 30, 1998 (1998-01-30) -& JP 09 246846 A (NTT IDO TSUSHINMO KK), September 19, 1997 (1997-09-19). This prior publication covers two stripline segments which

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are in the form of circle segments and are arranged  
offset with respect to one another in the  
circumferential direction and at a different distance  
from a central center point, in which case a tapping  
5 element can be moved about this center point, engaging  
with the respective stripline segment. The tapping  
element in this case comprises two radial elements,  
which are offset with respect to one another with an  
angular separation in plan view, and are connected to  
10 one another at the center point, which lies on their  
pivoting axis.

**AMENDED SHEET**



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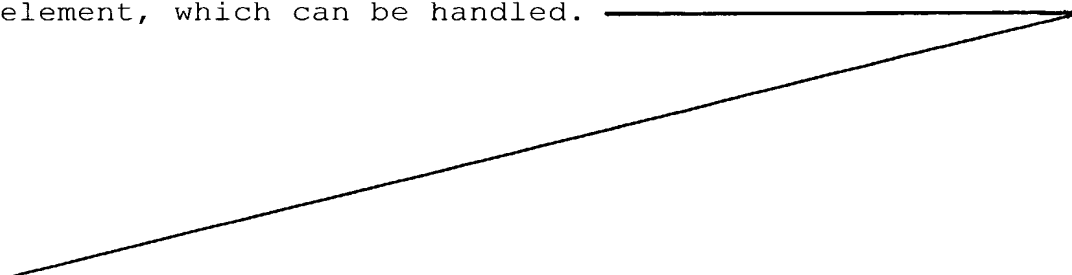
connected to a feed point and secondly forms a moveable tap or coupling point in the overlapping area with the respective stripline segment, which is in the form of a circle segment. A common connection line, which extends as far as the outermost circle segment, leads from the common feed point to the individual circle segments.

As mentioned, the stripline segments may be in the form of circle segments. The stripline sections may, in general terms, also be provided arranged concentrically with respect to one another, which also includes stripline sections which run in a straight line and are arranged parallel to one another (namely for the situation where the radius of the stripline sections which are in the form of circle segments becomes infinite).

Finally, one simple refinement according to the invention comprises the provision of a tapping element which passes over a number of stripline segments in the form of circle segments, like a radially running pointer, and hence forms a number of associated tapping points which are located one behind the other in individual stripline segments.

Finally, a type of bridge structure is possible, with connection lines which run in the same direction, are arranged one above the other when seen in a horizontal side view, can be moved about a common pivoting axis, and are rigidly connected to form a common tapping element, which can be handled.

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explain the capacitive coupling of the phase shift segment and of the center tap;

5 Figure 4: shows a modified exemplary embodiment of a phase shift assembly according to the invention having three circle segments;

10 Figure 5: shows a modified exemplary embodiment using two stripline sections which are not in the form of circle segments (which run in straight lines); and

15 Figures 6a and 6b show a polar diagram of an antenna array with an adjustable electrical notch, firstly for a notch at  $4^\circ$ , and secondly for a notch at  $10^\circ$ .

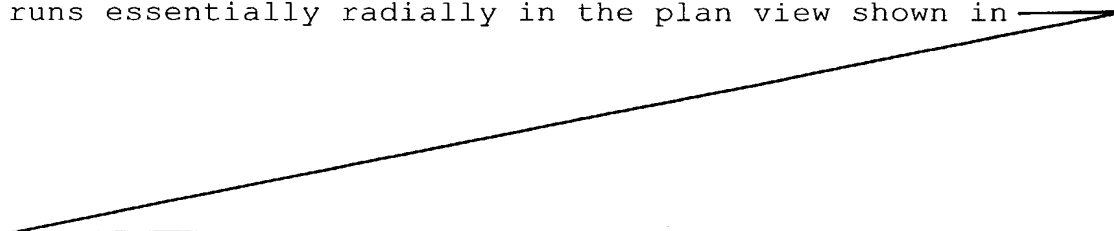
20 A first exemplary embodiment of a radio-frequency phase shift assembly according to the invention, which has stripline sections 21 offset with respect to one another, that is to say stripline segments 21 in the form of circle segments in the illustrated exemplary embodiment, namely an inner stripline segment 21a and

25 an outer stripline segment 21b which are arranged concentrically around a common center point in a plan view and through which a vertical pivoting axis 23 runs at right angles to the plane of the drawing, will be described with reference to Figure 2.

30

A tapping element 25, which is designed such that it runs essentially radially in the plan view shown in

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form of circle segments in the illustrated exemplary embodiment, namely an inner stripline segment 21a and an outer stripline segment 21b which are arranged concentrically around a common center point in a plan view and through which a vertical pivoting axis 23 runs at right angles to the plane of the drawing, will be described with reference to Figure 2.

A tapping element 25, which is designed such that it runs essentially radially in the plan view shown in Figure 2, runs from the pivoting axis 23 and in each case forms a coupled tapping section 27, which is also referred to as the tapping point 27 in the following text, in the respective area in which it overlaps an associated stripline segment 21, that is to say, in the illustrated exemplary embodiment, two tapping points 27a, 27b are provided, which are offset in the longitudinal direction of the tapping element 25.

The feed line 13 passes from the feed input 5 to a center tap 29, in whose region the pivoting axis 23 for the tapping element 25 is located.

The tapping element 25 is in this case broken down into a first connection line 31a, which extends from the coupling section 33 in the overlapping area of the center tap 29 to the tapping point 27a on the inner stripline segment 21a. The region which projects as an extension beyond this tapping point 27a forms the next connection section or connection line 31b, which leads to the tapping point 27b there, which is formed in the region in which it overlaps the outer stripline segment 21b.

The entire RF phase shift assembly is designed with the four dipoles 1a to 1d which are shown in the exemplary embodiment in Figure 2 jointly on a metallic base plate 35, which at the same time represents the reflector 35 for the dipoles 1a to 1d.



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be shared at the same time between the dipole radiating elements 1a and 1d, on the one hand, and the further pair of dipole radiating elements 1b and 1c, since the dipole antennas 1a to 1d are connected via antenna lines 41 to each end 39a and 39b, respectively, of the stripline segments 21a, 21b, which are in the form of circle segments.

A modified exemplary embodiment with a total of six dipole radiating elements 1a to 1f is shown in Figure 4, allowing phase shifts from  $+3\phi$  to  $-3\phi$  to be achieved in this case. Furthermore, if required, it is possible to achieve power sharing, for example from outside to inside, which allows power steps of 0.5 : 0.7 : 1, as is shown in the following table.

In this exemplary embodiment, as in the previous exemplary embodiment, however, a central dipole radiating element or a central dipole radiating element group, as is shown in Figure 1, may, however, also be provided, which has a phase shift angle of  $0^\circ$  and is directly connected to the feed line input.

Figure 5 shows two straight stripline sections 21a and 21b, which are offset with respect to one another and, in the illustrated exemplary embodiment, are offset with respect to one another through  $180^\circ$  with respect to the pivoting axis 23. This refinement is admittedly not part of the invention. However, a conversion according to the invention would be feasible to the extent that the stripline sections 21a and 21b, which are shown in Figure 5, are arranged such that they run parallel to one another and run in straight lines, are arranged on the same side of the center tap 29 and, at the same time, are covered by a single tapping element 25 in the form of a pointer.





further inward connection line (31a - 31c)  
which leads to the respective further inward  
tapping section (27a - 27c).

- 5 2. The phase shift assembly as claimed in claim 1,  
**characterized** in that the connection lines  
(31a - 31d) at the same time represent  
transformers, via which the power is shared in a  
defined manner between the tapping sections (27a -  
10 27d) of the plurality of stripline sections (21a -  
21d).
3. The phase shift assembly as claimed in claim 1, 2  
or 3, **characterized** in that the tapping element  
15 (25) is formed like a radial point element  
originating from the pivoting axis (23).
4. The phase shift assembly as claimed in claim 1, 2  
or 3, **characterized** in that the plurality of  
20 connections (31a - 31d) are arranged in an  
overlapping but isolated arrangement with respect  
to one another parallel to the pivoting axis (23)  
such that the individual connection lines  
(31 - 31d) each start at the center tap (29) or at  
25 the central coupling section (33), and run to the  
respective tapping section (27a - 27d) associated  
with a specific stripline section (21a - 21d).
5. The phase shift assembly as claimed in one of  
30 claims 1 to 4, **characterized** in that the share of  
the power which is fed in via the feed line (13)  
decreases from the innermost stripline section  
(21a) to the outermost stripline section (21d).
- 35 6. The phase shift assembly as claimed in one of  
claims 1 to 4, **characterized** in that the share of  
the power which is fed in via the feed line (13)



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12. The phase shift assembly as claimed in one of claims 1 to 11, **characterized** in that this phase shift assembly is formed on a conductive, in particular metallic, base plate (25), which is preferably formed by the reflector of the antenna (1).
13. The phase shift assembly as claimed in one of claims 1 to 12, **characterized** in that this phase shift assembly is shielded by a metallic cover.
14. The phase shift assembly as claimed in one of claims 1 to 13, **characterized** in that the connection line (31a - 31d) and the stripline sections (21a - 21d), together with the cover for the phase shift assembly, are in the form of a triplate line.
15. The phase shift assembly as claimed in one of claims 1 to 14, **characterized** in that the stripline sections (21a - 21d) each have a defined characteristic impedance.
16. The phase shift assembly as claimed in one of claims 1 to 15, **characterized** in that a center tap (29) for the tapping element (25) is separated from, and is held above, the reflector (35) by means of a dielectric (37a).
17. The phase shift assembly as claimed in one of claims 1 to 16, **characterized** in that the at least two stripline sections (21a, 21b) are curved, and in particular are in the form of circle segments.
18. The phase shift assembly as claimed in 17, **characterized** in that the center points of the at least two stripline sections (21a to 21c) which



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are in the form of circle segments are arranged such that they run in the form of circle segments around a common center point.

- 5 19. The phase shift assembly as claimed in one of claims 1 to 18, **characterized** in that the center points of the stripline sections (21a to 21c) lie on the pivoting axis (23) of the tapping element (25).
- 10 20. The phase shift assembly as claimed in one of claims 1 to 17, **characterized** in that the center points of the stripline sections (21a to 21c) and the center point of the pivoting axis (23) are  
15 offset with respect to one another.
21. The phase shift assembly as claimed in one of claims 1 to 16, **characterized** in that the stripline sections (21a to 21c) run in straight  
20 lines, and are preferably formed parallel to one another.
22. The phase shift assembly as claimed in one of claims 1 to 21, **characterized** in that the  
25 stripline sections (21a to 21c) have different thicknesses.
23. The phase shift assembly as claimed in one of claims 1 to 22, **characterized** in that the  
30 stripline sections (21a to 21c) have different impedance values or identical impedance values, in particular around 50 Ohms.

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Radio-frequency phase shift assembly

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**Abstract:**

An improved radio-frequency phase shift assembly is distinguished by the following novel features:

- at least one further stripline section (21b, 21c, 21d) is provided, and is arranged concentrically with respect to the first stripline section (21a),
- further connection lines (31b, 31c, 31d) are provided, via which an electrical connection is produced at least indirectly from the feed line (13) to the respective tapping section (27a - 27d) associated with a stripline section (21a, 21b, 21c, 21d),
- two different pairs of antenna radiating elements (1a, 1b, 1c, 1d, 1e, 1f) can be driven with different phase angles ( $\phi$ ) at mutually offset tapping points (39a, 39b) on the at least two stripline sections (21a, 21b, 21c, 21d), and
- the plurality of connection lines (31a - 31d) are mechanically connected to one another.

(Figure 2)

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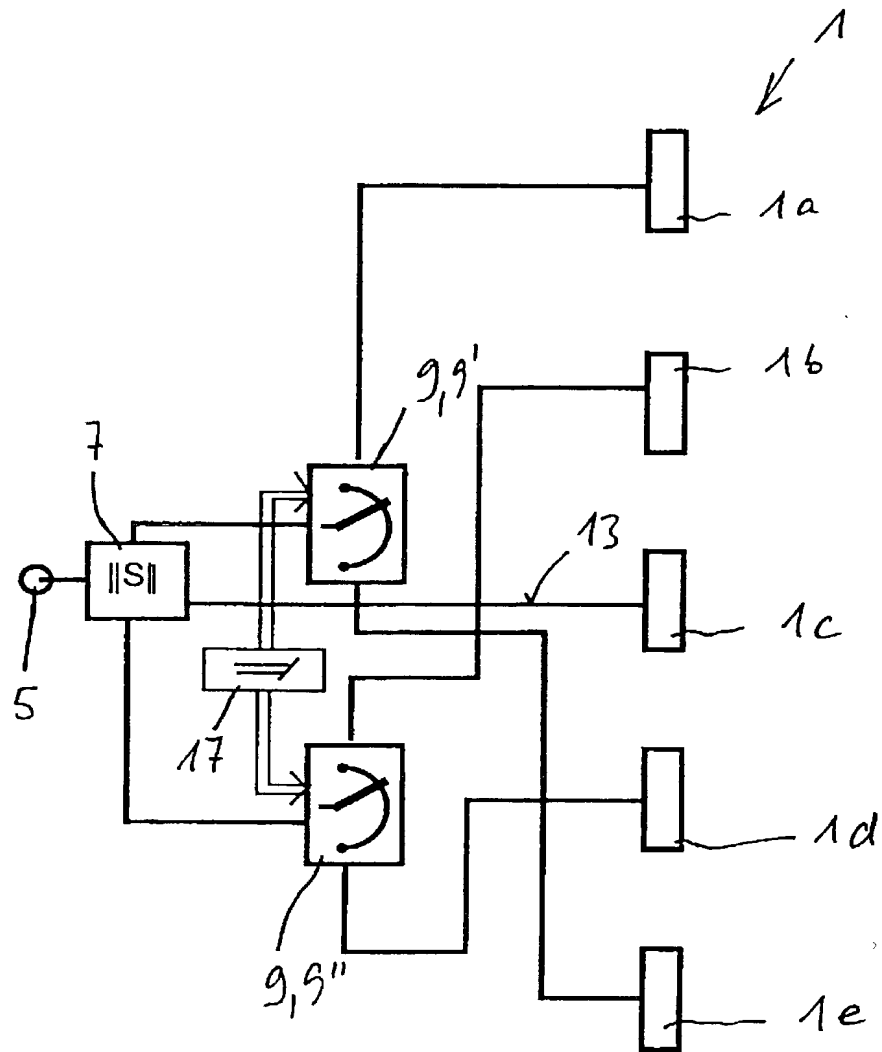


Fig. 1

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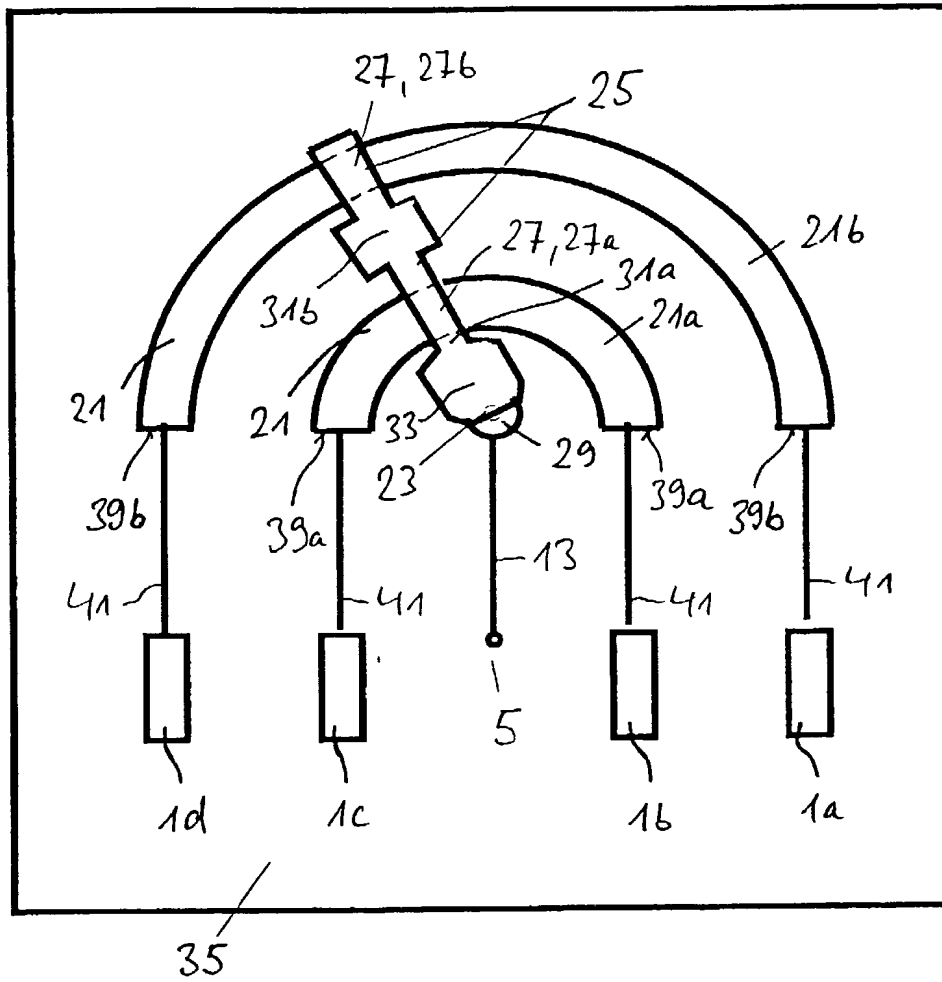


Fig. 2

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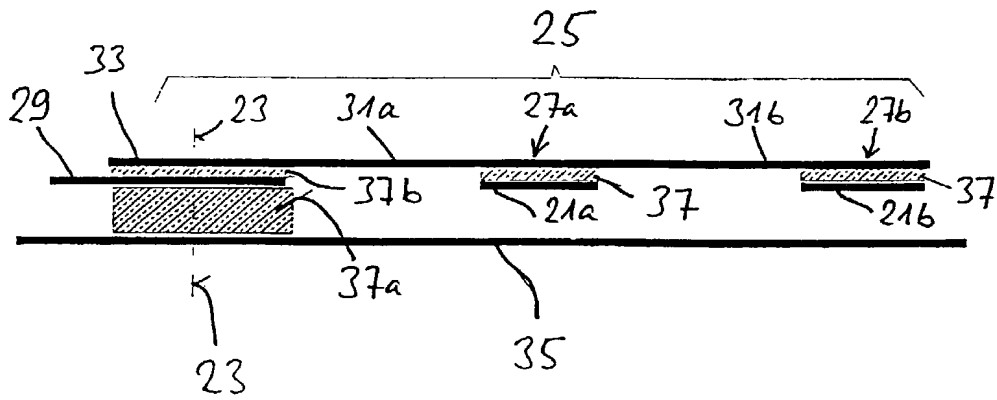
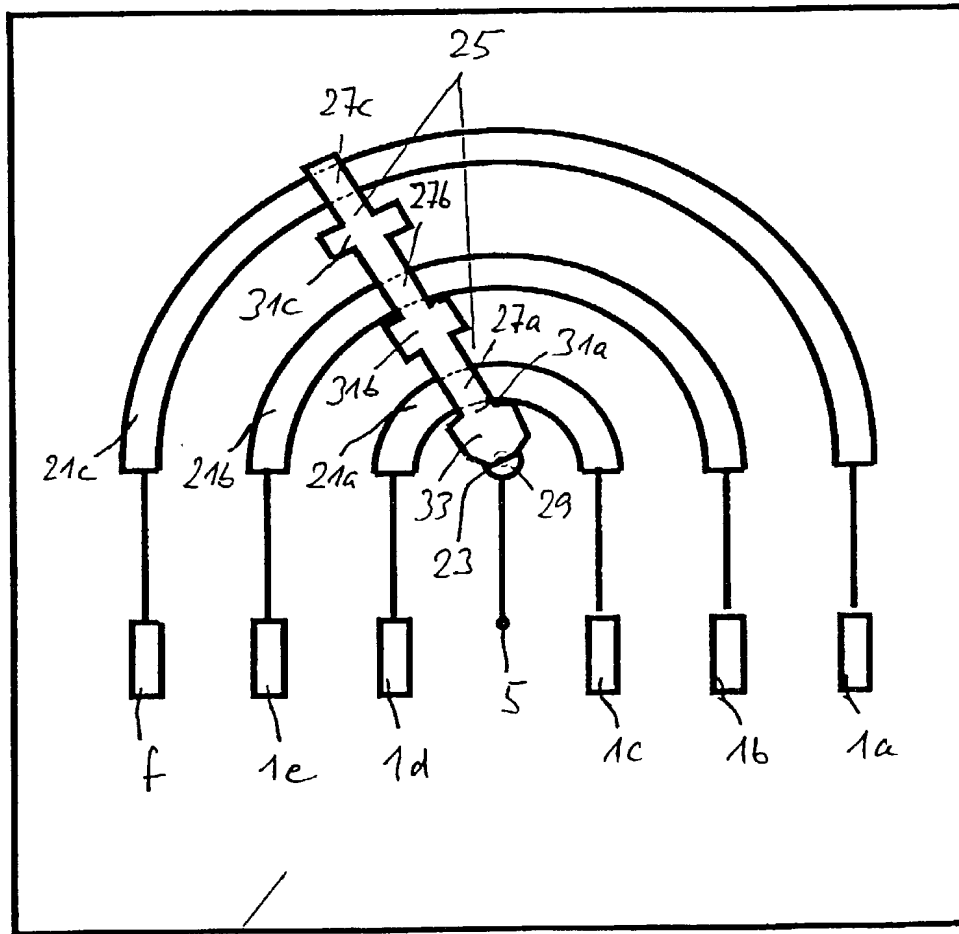


Fig. 3

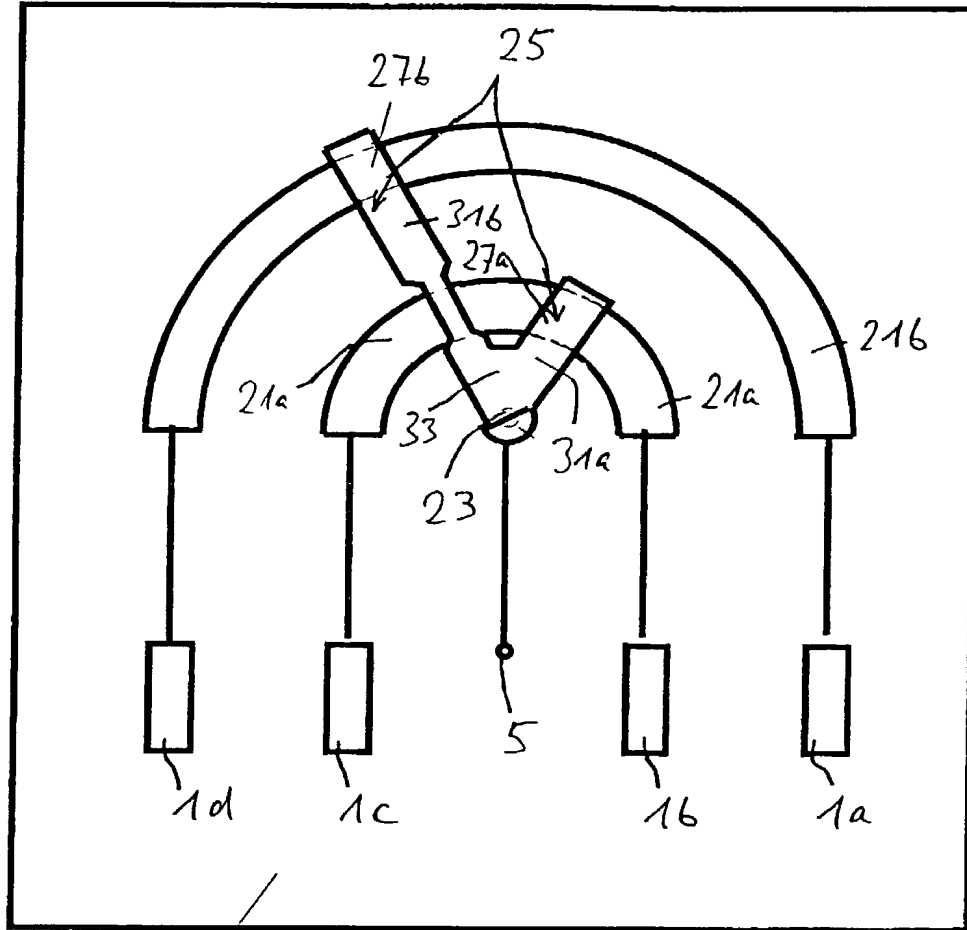
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Fig. 4

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Fig. 5

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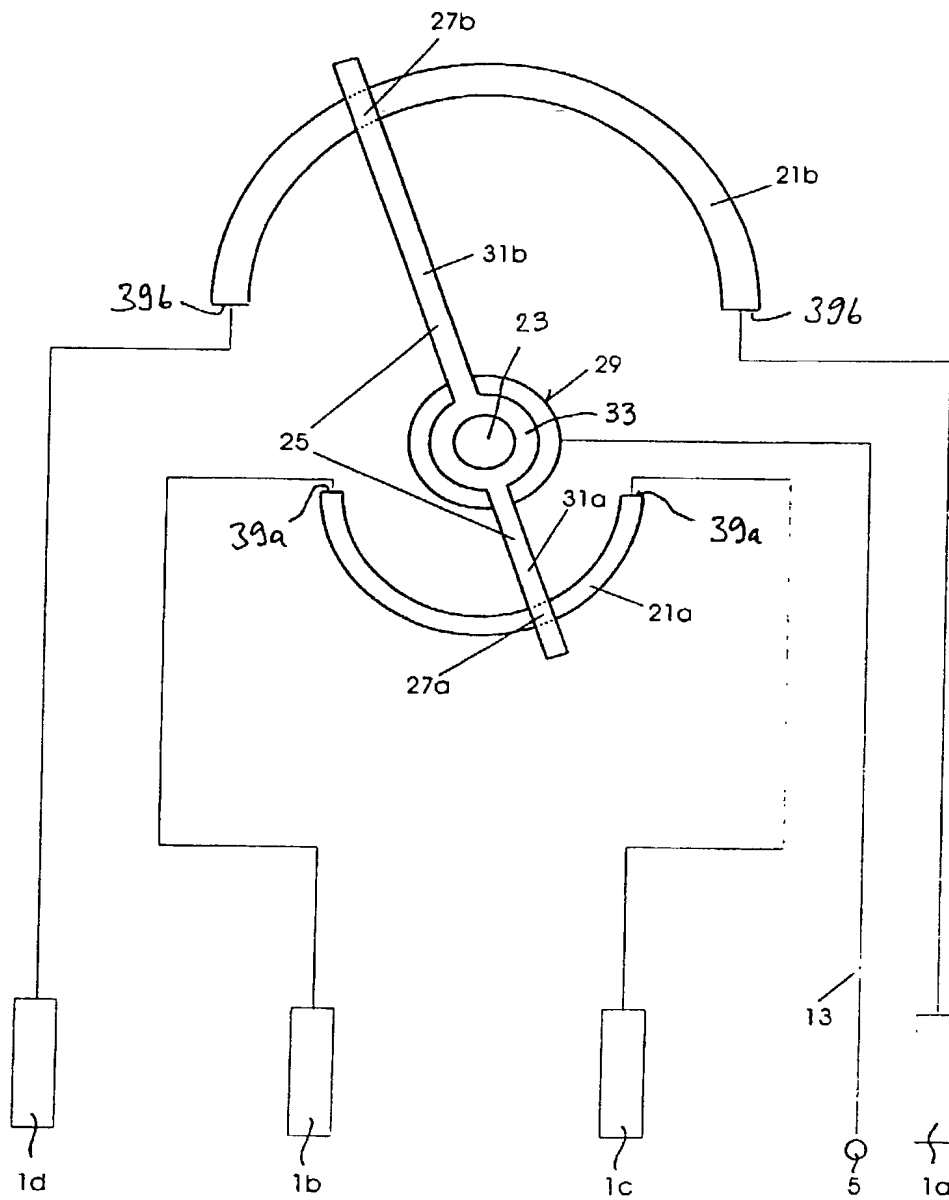


Fig. 6



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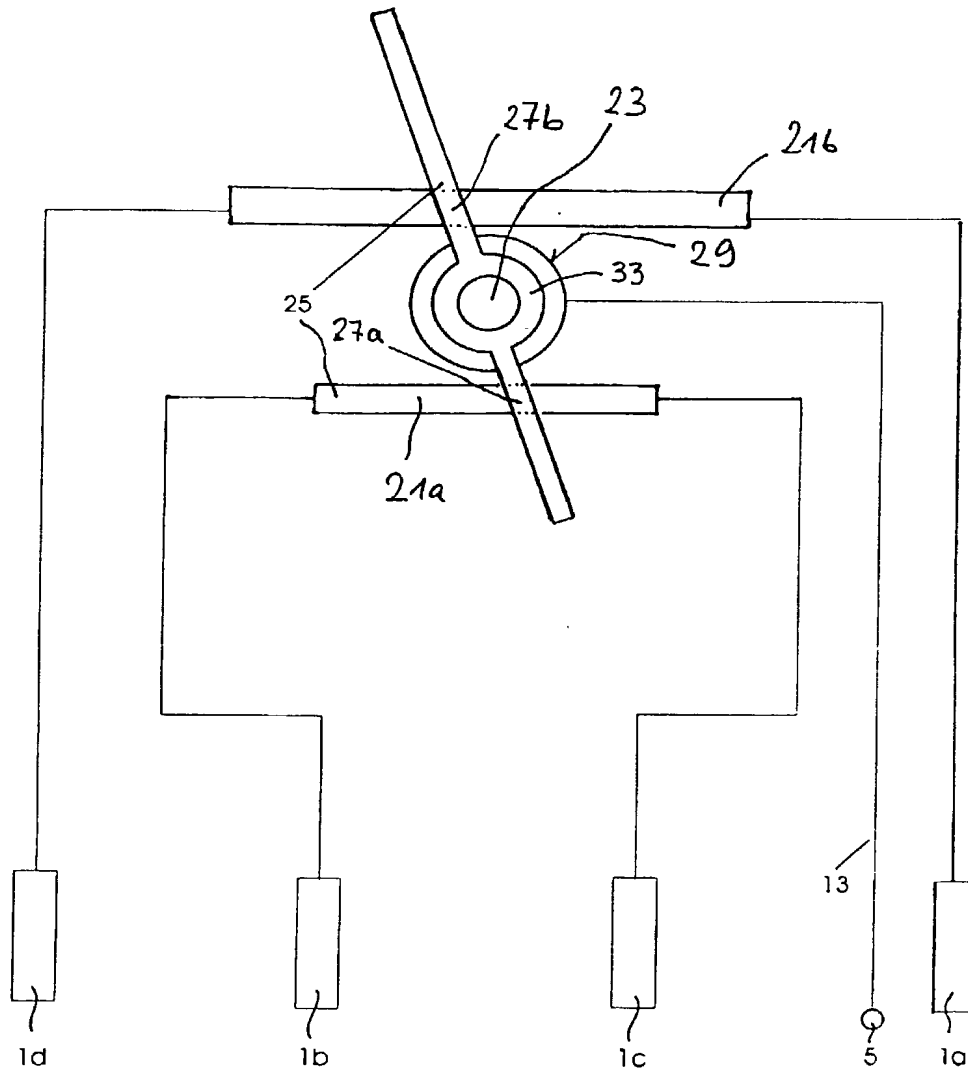


Fig. 7

Fig. 8b

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345 247 US FL/SNixon & Vanderhye P.C. (10/89)  
(Domestic Non-Assigned/Foreign) Page 1

**RULE 63 (37 C.F.R. 1.63)**  
**INVENTORS DECLARATION FOR PATENT APPLICATION**  
**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

As a below named inventor, I hereby declare that my residence, mailing address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**HIGH-FREQUENCY PHASE SHIFTER UNIT**

the specification of which (check applicable box(es)):

☐ is attached hereto  
☐ was filed on \_\_\_\_\_ as U.S. Application Serial No. \_\_\_\_\_ (Atty Dkt. No. 265-106)  
☒ was filed as PCT International application No. PCT/EP00/07236 on 27/07/2000  
 and (if applicable to U.S. or PCT application) was amended on 28/07/2001

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose to the Patent Office all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Application Number	Country	Day/Month/Year Filed
199 38 862.8	DE	17/08/1998

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number	Date/Month/Year Filed
--------------------	-----------------------

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT international applications listed above or below:

Prior U.S./PCT Application(s): Application Serial No.	Day/Month/Year Filed	Status: patented pending, abandoned
PCT/EP00/07236	27/07/2000	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. And on behalf of the owner(s) hereof, I hereby appoint NIXON & VANDERHYE P.C., 1100 North Glebe Rd., 8<sup>th</sup> Floor, Arlington, VA 22201-4714, telephone number (703) 818-4000 (to whom all communications are to be directed), and the following attorneys thereof (of the same address) individually and collectively owner's/owners' attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent: Larry S. Nixon, 25640; Arthur R. Crawford, 25327; James T. Hosmer, 30184; Robert W. Farls, 31352; Richard G. Besha, 22770; Mark E. Nusbaum, 32348; Michael J. Keenan, 32106; Bryan H. Davidson, 30251; Stanley C. Spooner, 27393; Leonard C. Mitchard, 29009; Duane M. Byers, 33363; Jeffrey H. Nelson, 30481; John R. Lastova, 33149; H. Warren Burnham, Jr. 29366; Mary J. Wilson, 32955; J. Scott Davidson, 33489; Alan M. Kagen, 36178; Robert A. Molan, 29834; B. J. Sadoff, 36683; James D. Berquist, 34776; Updeep S. Gill, 37334; Michael J. Shea, 34725; Donald L. Jackson, 41090; Michelle N. Lester, 32331; Frank P. Presta, 18828; Joseph S. Presta, 35329; Joseph A. Rhoa, 37515; Raymond Y. Mah, 41426; Chris Comuntzis, 31097; Gary T. Tanigawa, 43180. I also authorize Nixon & Vanderhye to delete any attorney names/numbers no longer with the firm and to act and rely solely on instructions directly communicated from the person, assignee, attorney, firm, or other organization sending instructions to Nixon & Vanderhye on behalf of the owner(s).

1-00	Inventor's Signature: <u>Maximilian</u>	Date: <u>15.01.02</u>
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☒ See attached sheet(s) for additional inventor(s) information!!

15-FEB-2002 11:17

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Serial No.

3-00

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FOR ADDITIONAL INVENTORS, check box ☐ and attach sheet with same information and signature and date for each.

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GESAMT SEITEN 05